

April 18, 1933.

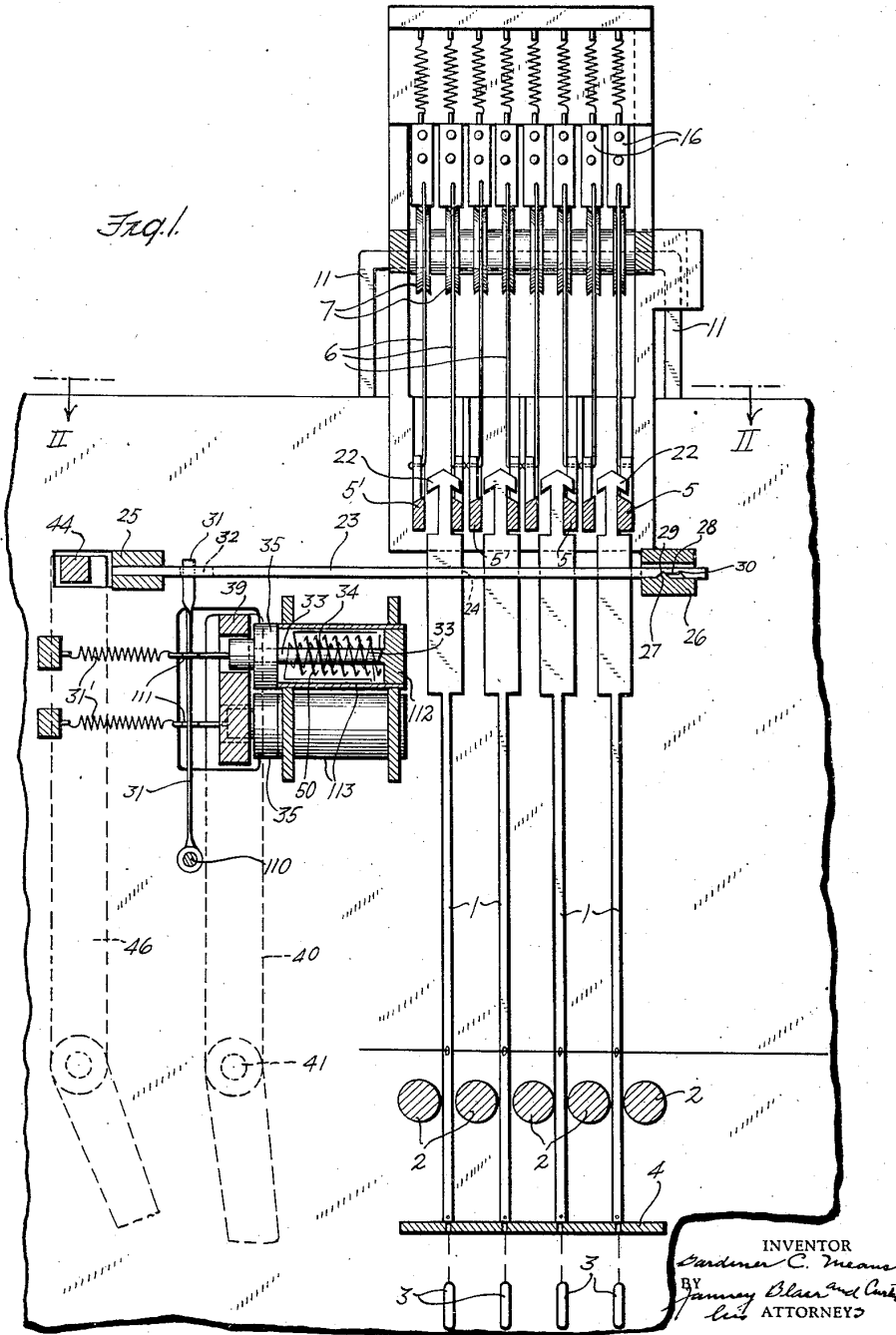
G. C. MEANS

1,904,006

PATTERN CONTROL MECHANISM

Filed March 22, 1929

6 Sheets-Sheet 1



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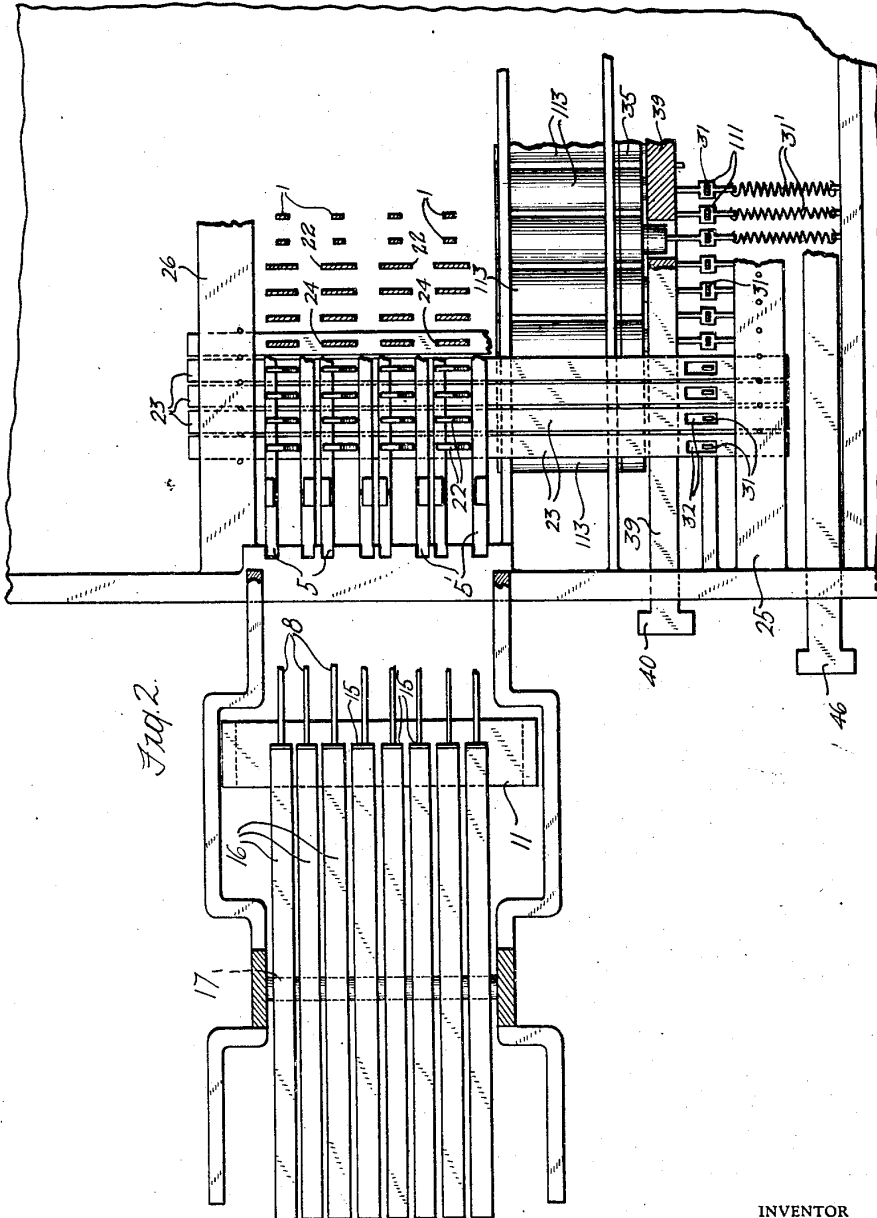
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PATTERN CONTROL MECHANISM

Filed March 22, 1929

6 Sheets-Sheet 2



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PATTERN CONTROL MECHANISM

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6 Sheets-Sheet 3

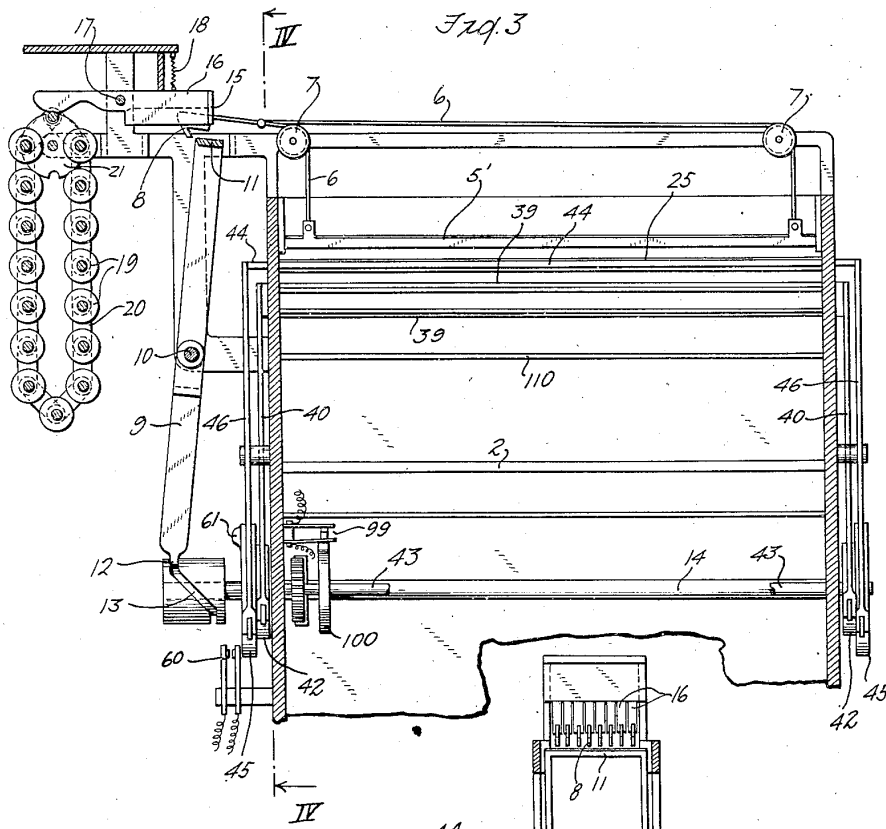
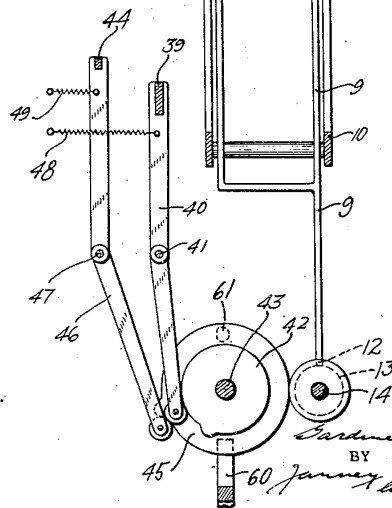


Fig. 4.



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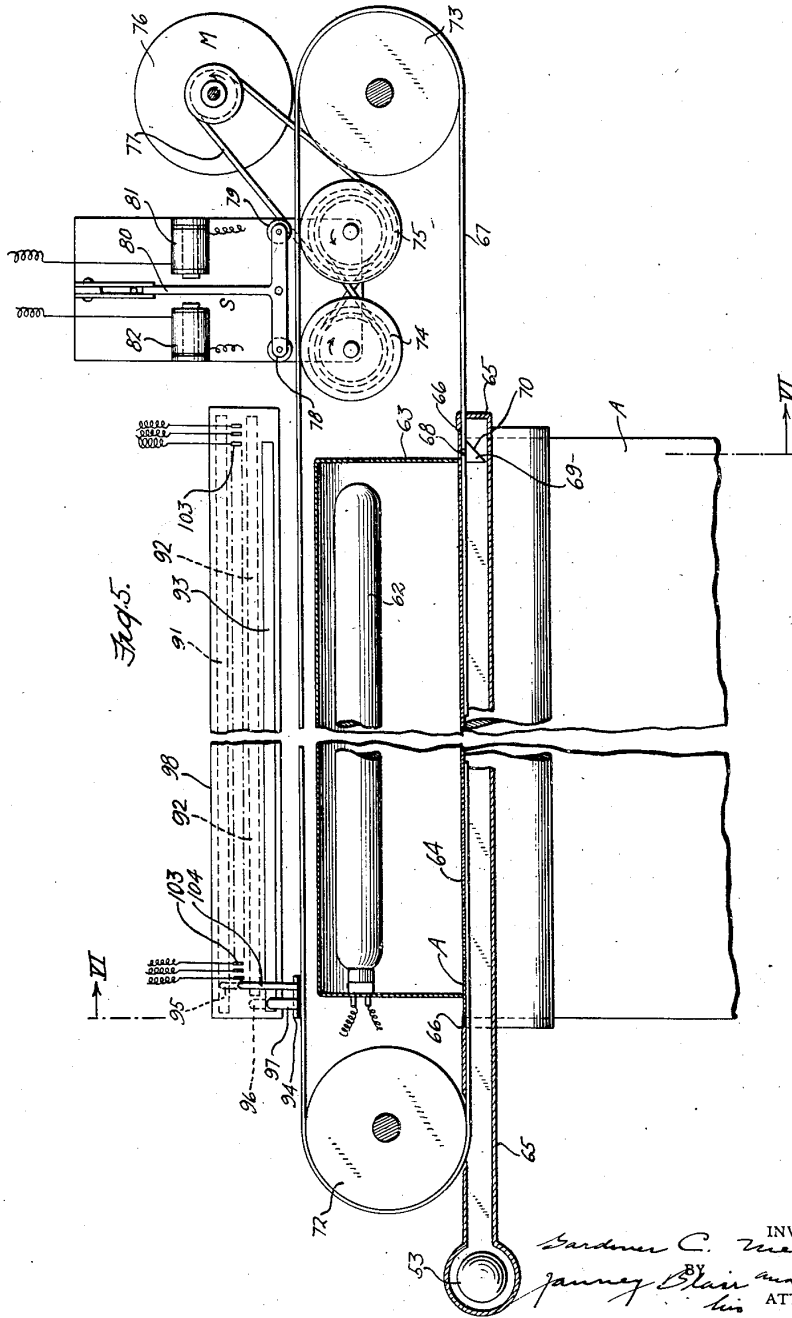
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PATTERN CONTROL MECHANISM

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6 Sheets-Sheet 4



April 18, 1933.

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PATTERN CONTROL MECHANISM

Filed March 22, 1929

6 Sheets-Sheet 5

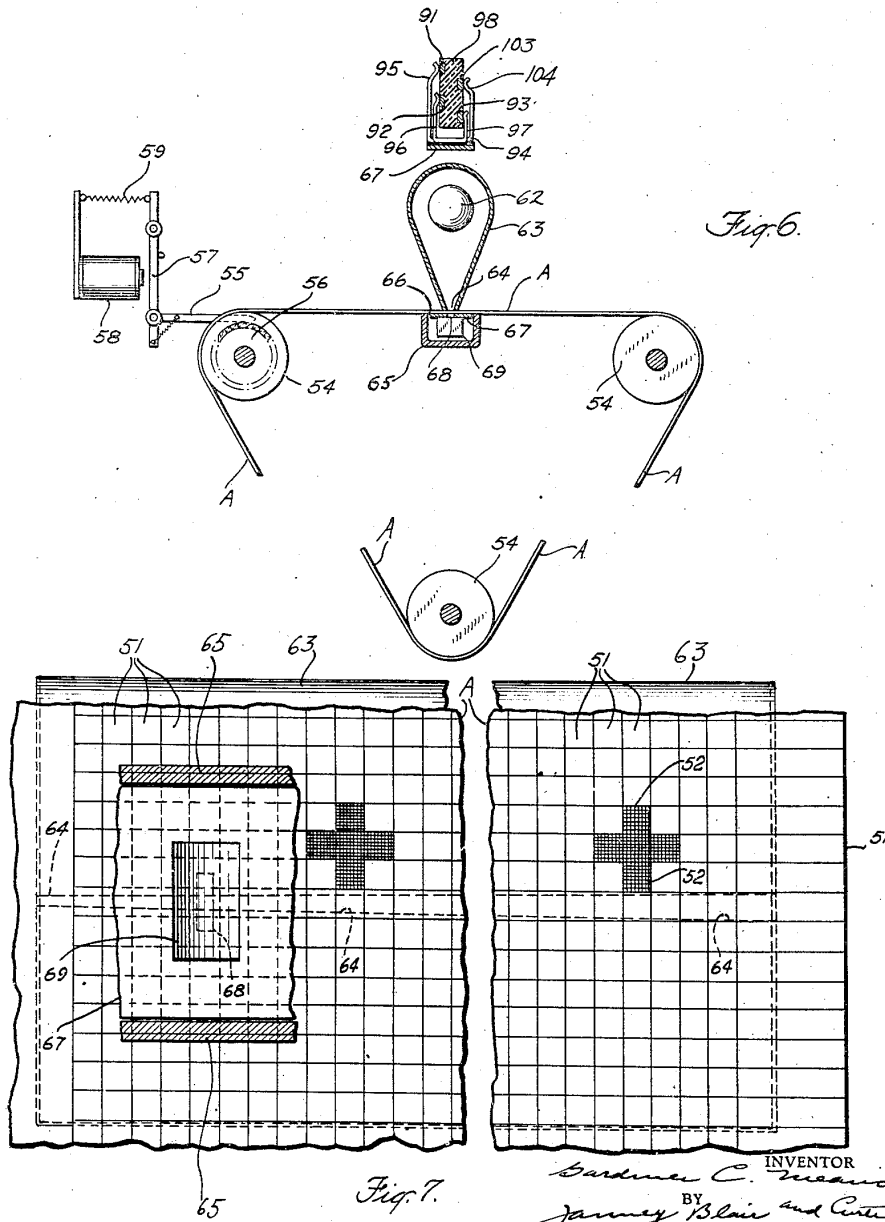


Fig. 6.

Fig. 7.

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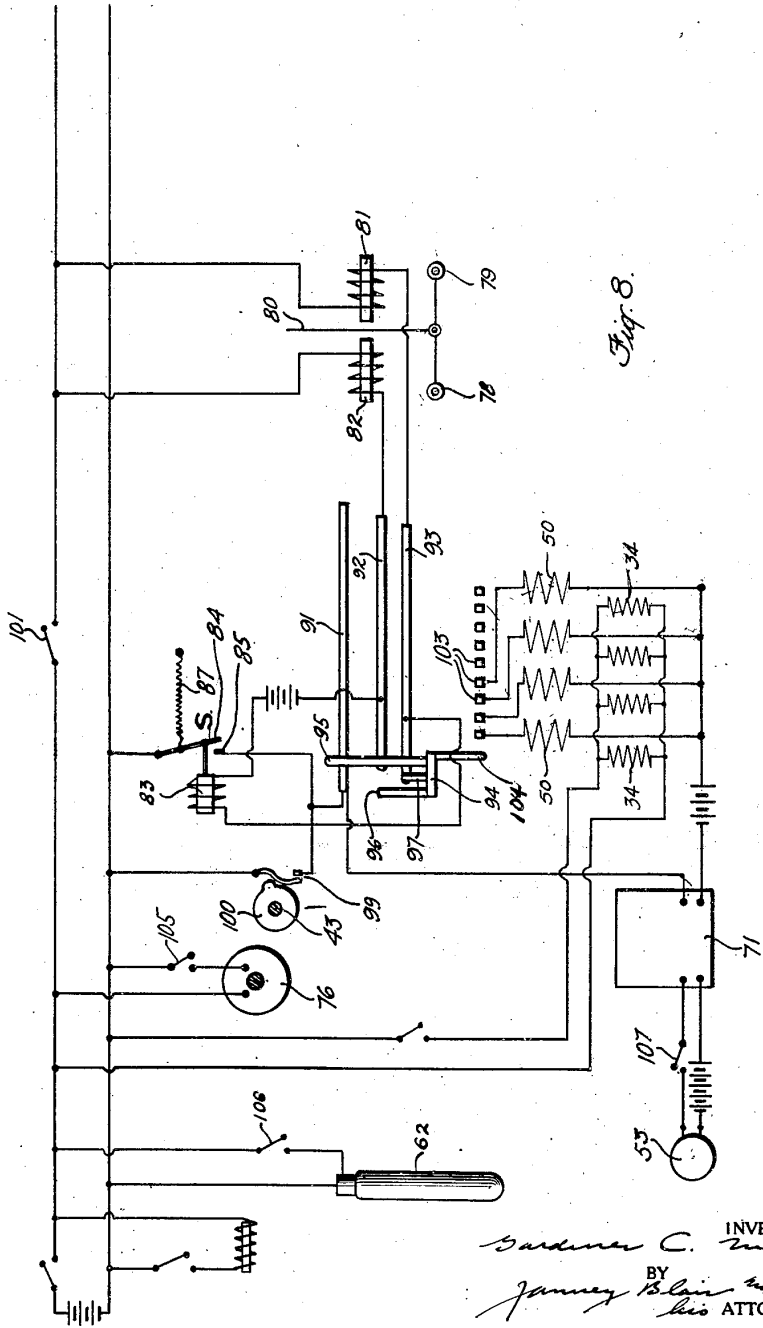
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PATTERN CONTROL MECHANISM

Filed March 22, 1929

6 Sheets-Sheet 6



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PATTERN CONTROL MECHANISM

Application filed March 22, 1929. Serial No. 349,034.

The present invention relates to an improvement in pattern control mechanism for fabric forming machines. One object thereof has been to provide a pattern control mechanism in which pattern changes are communicated to the fabric forming instrumentalities through the agency of selectively controlled variations in a magnetic or electromagnetic field such for example as may be effected by the use of a pattern sheet in the form of a photographic or other representation having portions presenting different values of light and dark directly in conjunction with suitably sensitive devices adapted to vary the current in such a field in accordance with the occurrence of said light and dark portions on said pattern sheet. In the application of my invention to a loom, either incorporated therein or as an attachment thereto, it is contemplated that my improved apparatus may be utilized in place of the jacquard card and known selective mechanism associated therewith.

Although the jacquard in its better developed and coordinated forms affords a pattern control of high technical perfection, it presents from its very nature an economic or commercial disadvantage which so far as I am aware has never been successfully overcome. As is known, the jacquard pattern changes are mechanically communicated to the fabric forming instrumentalities of a loom, for example, from a series of cards or their equivalent. The preparation of these cards, where they represent a large or involved pattern, requires the services of highly skilled artisans over an extended period of time. This with other factors, ordinarily imposes a heavy initial burden of expense on the weaver which must be absorbed either by selling the fabric at a prohibitive per yard price or by spreading the expense over a large yardage of the same pattern at a lower price. If there proves to be no adequate demand for the fabric, a substantial loss is incurred. Other commercial and economic disadvantages arising from this feature of the weaving industry will readily be apparent.

One of the purposes of my invention is to

provide a pattern control mechanism which will operate directly from a pattern of a type which eliminates the necessity for producing a mechanical equivalent. For example, I contemplate that such a pattern may be a previously formed fabric or photograph or other representation of a fabric. It may be a drawing or other representation or a facsimile of a fabric design, or it may be in the form of a conventionalized design, as a suitable grouping of markings to define or designate predetermined characteristics or changes to be incorporated or effected in the design of the fabric produced.

It will be obvious that the initial cost of a pattern such as I have referred to as being contemplated in connection with my invention is practically negligible as compared to the cost of jacquard cards. This affords the weaver a chance to execute fabrics from special designs in relatively small quantities at a price which will attract business. It also permits the weaver at low cost to try out the demand for or popularity of a wide variety of fabrics so that any given portion of his looms may be kept in production only on fabrics which have found a ready market. Other advantages derivable from the use of my invention will be apparent to those conversant with the art.

One embodiment of my invention as applied to a loom is illustrated in the accompanying drawings forming part of this specification and in which:

Figure 1 is a view partly in vertical section of a portion of a loom showing more particularly a group of heddles, griffs for lifting the same and a portion of my selector mechanism;

Figure 2, a view partly in horizontal section on the line II—II of Figure 1;

Figure 3, a view partly in vertical section showing more particularly one form of griff operating and control mechanism and resetting means forming part of or cooperating with my selector mechanism;

Figure 4, a view partly in vertical section on the line IV—IV of Figure 3;

Figure 5, a view partly in longitudinal

vertical section of one form of pattern responsive light transmitting mechanism;

Figure 6, a view partly in transverse vertical section on the line VI—VI of Figure 5 and showing more particularly one form of pattern actuating mechanism cooperating with the light transmitting mechanism;

Figure 7, a fragmentary plan view of a pattern in operative position with respect to the light transmitting mechanism; and,

Figure 8, a wiring diagram.

In the drawings, my invention is shown in connection with fabric forming instrumentalities of a loom of well known type including heddles 1 mounted to oscillate vertically between guides 2 and provided if desired with weights 3 by which the heddles are normally held in lowered position with their ends resting on a stop 4. Any appropriate heddle actuating or lifting devices may be employed, as for example, griffs 5 and 5', each suspended at one end of a cord or cords 6 which pass over pulleys 7, Figure 3, the other end of said cords being operatively connected with a reciprocable hook 8.

Effective griff actuating movement of said hooks 8 is accomplished by means of a rocker arm 9 pivoted on the loom frame at 10 and provided at its upper end with a hook engaging member, as a bar 11, and at its lower end with a cam follower 12 which engages a cam slot 13 in a rotatable cam mounted on the main shaft 14 actuated from any suitable source of power, not shown.

Any suitable expedient may be employed to select predetermined griffs for operation by the mechanism just above described. I have illustrated in Figures 3 and 4 a known form of griff selector mechanism which includes a detent 15 mounted at one end of a lever 16 pivoted at 17. A tension spring 18 normally holds the forward or detent carrying end of lever 16 in raised position. A portion of the rear end of the lever is positioned to engage lever tilting cams 19 mounted at any desired predetermined intervals on a pattern chain 20 which advances with step-by-step rotation of a sprocket 21 operating in synchronism with the fabric forming loom mechanism in a well known manner. In operation, the detent 15 depresses the hook 8 into position to be engaged and moved outwardly by the bar 11 whenever a cam 19 engages the outer end of lever 16. It will be understood that in a very simple loom each hook 8 will actuate a single griff although my invention is applicable to looms employing griff controlling and heddle actuating mechanism of widely varying types. In the embodiment shown in Figure 1 the heddles 1 are provided with undercut heads 22 normally positioned between the griffs 5 and 5' which may remain idle or be actuated singly or together in accordance with a predetermined arrangement or pattern. With the

parts positioned as indicated in the drawings, each head 22 is in position to be raised by upward movement of the griff 5 shown at its right.

No picker mechanism is shown but it is contemplated that such is included in an operative loom and that it will function in the usual manner.

To vary the fabric pattern in accordance with a predetermined design and in a manner contemplated by my invention, it is desirable to provide readily controllable means for deflecting the head 22 laterally to a position at the left for actuation by the griff 5' or at the right for actuation by the griff 5. For this purpose, I provide a heddle bar 23 having longitudinal slots 24 through which upper portions of the heddles 1 extend. Four heddles are shown in this relation but the number may be varied. The opposite ends of bar 23 are slidably mounted in suitable supports or bearings 25 and 26 respectively, the latter being provided with a ridge or projection 27 positioned to engage a recess 28 in the under face of said bar 23, said recess having projection receiving end notches 29 and 30 respectively. This construction or its equivalent is provided to prevent accidental endwise or heddle actuating movement of the bar 23, such as might otherwise result from vibration of the machine.

One embodiment of means for controllably actuating one of the heddle bars includes a lever 31 pivoted at 110 and engaging a slot 32 in said bar 23. A tension spring 31' has one end secured to a rigid portion of the loom and its other end operatively connected to said lever 31 as by a loop 111, Fig. 2, embracing said lever. Said spring is also connected to the armature 35 of an electro-magnet having a core 33 continuously energized by a coil 34. As shown in Figure 1, said armature is provided with a recess which receives the free or projecting end of core 33 so that the armature is readily slidable on said core.

In the embodiment shown, core 33 is magnetically continuous with a magnetizable base 112 and a magnetizable shell 113 so that when armature 35 is in retracted position, it will close a continuous magnetic circuit through said core, base and shell. It will be understood that the magnetic effect of the magnet just described will normally be sufficient to retain said armature in retracted position against tension of the spring 31' thus holding the lever 31 in retracted position.

Assuming that a loom is provided with a plurality of heddle bars, as 23, and actuating means therefor as shown, or their equivalent, it will also be desirable to provide means for selectively controlling the action of said bars through said actuating means in accordance with a pattern so that fabrics of a wide range of design may readily be made.

This involves selectively releasing predetermined armatures 35 from retracted position on their respective cores 33 to effect or permit movement of corresponding bars 23 in one direction, left for example, periodically returning said bars together with the corresponding heddles to their right hand position, Figure 1, and periodically returning said armatures 35 to retracted core engaging position.

The armature releasing mechanism hereinabove described includes means for controllably varying the magnetic effectiveness of core 33 comprising a coil 50 wound in opposition to coil 34 and so calibrated that, when it is energized by closing of its circuit the magnetic field of the electro-magnet is sufficiently weakened to cause release of armature 35 from contact with the edge of shell 113 of said magnet whereupon by operation of spring 31' said armature without disengaging from core 33 slides lengthwise thereof and into engagement with a perforated bar 39 mounted on a lever 40 pivoted at 41 and to which rocking motion is imparted in one direction by a cam 42 mounted on a shaft 43 suitably geared to or otherwise connected with main shaft 14, Figures 3 and 4, and in the opposite direction by a spring 48. With left hand movement of bar 39 spring 31' pulls lever 31 and with it bar 23 to the left. A heddle bar resetting member or pusher 44, positively actuated toward the right by a cam 45, through a rocker arm pivoted at 47, is deflected toward the right to push the bars 23 back to their original or right hand position, as shown in Figure 1, said arm being returned to its left hand position by means of spring 49. Meanwhile the perforated bar 39 is returned to the right or armature intercepting position, thus completing the cycle of operation.

Having described a form of mechanism whereby the heddles are moved from one position to another, with respect to the griffs 5 and 5' and back again, I will describe one embodiment of a selector mechanism whereby the sequence or occurrence of movements of selected heddles may be automatically controlled from a suitable pattern without the interposition of an intermediate mechanical equivalent of the design web or the punched cards of a jacquard. Such a device is one which selectively controls movement of the warp threads directly in response to indications of pattern variations such for example as are presented by a drawing, picture, photograph, conventional representation of a design or the like, and other than the series of punched cards or design web of the jacquard. From the previously described portions of apparatus employed in connection with an embodiment of my invention, it will be clear that the control or selection hereinabove referred to may be effected through the coils 50. In

other words, by controllably varying the magnetizing current in selected coils, the heddle or heddles respectively associated therewith and their corresponding warps will be moved or not moved with respect to griffs 5 and 5' to form any desired fabric design, the changes of which may be effected or incorporated in the fabric in connection with the laying of each single filler thread or of any desired number of threads in a group.

One form of apparatus by means of which I selectively vary the current in coils 50 and thus achieve the desired design control involves the use of a pattern sheet A, Figure 7, which in the form shown is of translucent flexible material, although I contemplate that an opaque material having surface portions of different light reflecting values as a photograph, drawing, or actual fabric, or a translucent or opaque material having portions of different colors may be employed in connection with suitable variants of the embodiment hereinabove described to secure substantially equivalent results. In the illustrated embodiment of my invention, selected portions of the pattern sheet bear markings which in effect produce a drawing presenting a design in terms of light areas 51 and dark areas 52, thus determining the relative values of light transmitted through different portions of said sheet. However, where the pattern is other than a fabric, a facsimile of the fabric design to be produced, or a photograph or the like, the sheet may be provided with markings which divide the surface into pattern units as squares, rectangles or spaces of other shape and of convenient or suitable area. In a simple form of apparatus, each longitudinal row of units on the pattern sheet corresponds to a warp thread or a plurality of warp threads and each transverse row to a filler thread or a plurality thereof. By varicoloring or otherwise varying the light reflecting or transmitting characteristics of selected units or areas, instrumentalities for controlling operation of the corresponding heddles may be made effective through the operation of a light sensitive device, as a selenium or photo-electric cell or other suitable apparatus for producing an electric current varying in some known degree with the intensity of the light to which it is exposed.

As shown in Figures 5 and 6, the pattern sheet A is assembled in operative relation to a light sensitive or photo-electric cell 53, indicated in Figure 8, which, in response to light and dark variations in said pattern, varies the amount of current in the coils 50. Said pattern, preferably in the form of an endless strip, is conveniently mounted on pattern advancing rollers 54 to which a step-by-step movement is imparted by a pawl 55 cooperating with a ratchet 56 operatively connected to one of said rollers 54. The pawl

55 is mounted on a pivoted armature arm 57 actuated in one direction by a magnet 58 and in the opposite direction by tension of a spring 59. The parts just described are so proportioned and assembled that the pattern sheet is periodically advanced over a distance equal to the longitudinal dimension of a pattern unit or area corresponding to one or any desired number of successively laid filler threads in the fabric design. In other words, the period may be that of one passage of the shuttle in one direction across the shed or any number thereof. In the illustrated apparatus, a switch 60 interposed in the circuit of the pattern advancing magnet 58, is periodically closed by a spring contact disposed in the path of a lug 61 positioned on the cam 45, Figure 4, in such a way that each increment of pattern sheet advance takes place in proper predetermined sequence with respect to the previously described heddle actuating and resetting mechanism.

Between successive increments of advance of the sheet A, a single transverse row of its pattern units is positioned in operative relation to a source of light and to means for progressively applying the varying light transmitting effect of the differently colored or valued units or areas in said row to the cell 53. As shown in Figures 5 and 6, a source of light, as a lamp 62, is positioned in a housing 63 provided interiorly with reflecting surfaces preferably such that light rays from the source concentrate substantially over an elongated slot-like opening 64 in a lower portion of the housing 63, said opening being long enough to extend across a complete row of pattern units and, if desired, narrower at the end adjacent to cell 53 than at its opposite end, Figure 7, to equalize the difference, if any, in cell effecting values of the light transmitted to the cell from different distances.

The cell 53 is positioned at one end of a tube or tube-like housing 65 having a longitudinal opening 66 opposite the opening 64 in housing 63. The pattern sheet A is operatively arranged between and transversely across said openings 64 and 66. A reciprocable shutter strip 67 movable longitudinally with respect to said openings 66 and 64 passes between the pattern sheet A and the light sensitive cell and is provided with an aperture 68 which is located opposite one face of a reflecting prism 69 and preferably somewhat longer than the width of opening 64, Figure 7, to allow for deviation of the strip 67 from true alignment with the opening 64. The prism 69 is secured to the under side of shutter strip 67 and has its reflecting surface 70 so positioned with respect to the aperture 68 that light rays coming through said aperture are reflected through the housing 65 and into effective contact with the cell 53. It will be apparent that, in operation,

when aperture 68 comes opposite or beneath a relatively light or translucent pattern unit, a certain intensity of light reaches the reflecting prism surface 70 and upon contact with cell 53 produces an electric current of determinable value. Obviously, when aperture 68 comes opposite or beneath a dark or opaque pattern unit, less light is transmitted to cell 53 so that less current or no effective current is produced therein. As indicated diagrammatically in Figure 8, the output of cell 53 connects with an amplifier, as a vacuum tube set 71, of any suitable type and the output of said amplifier is common to the several parallel circuits of coils 50.

To produce successive exposures of prism 69 to light coming through the units of any given row of pattern units via aperture 68, the shutter strip 67, in the form of an endless band, is extended over the peripheries of pulleys 72 and 73 to which alternate rotation in opposite direction is imparted by any suitable reversible driving means. As shown in Figure 5, friction drive wheels 74 and 75 are operatively positioned opposite the under face of an upper portion of strip 67 and are continuously actuated simultaneously in opposite directions, as by a motor 76 and belt 77. A suitable form of clutch for effecting the to-and-fro motion of strip 67 and thereby of prism 69 is provided and may conveniently be of the type illustrated, which includes contact rollers 78 and 79 respectively pivotally mounted on opposite ends of the cross member of a T-shaped armature bar 80 and adjacent to peripheral portions of the drive wheels 74 and 75 respectively. When not in operation the armature bar 80 occupies a position midway between magnets 81 and 82. If the coil of magnet 82 is energized, armature bar 80 is deflected to the left, Fig. 5, thus swinging the contact roller 78 into engagement with the shutter strip 67 and pressing the latter into effective driving engagement with the drive wheel 74. This operation moves prism 69 toward cell 53. By cutting out coil 82 and energizing coil 81, prism 69 is moved in the opposite direction or back to the position shown in Figure 5. Obviously, the traverses of the prism must be timed to take place between successive increments of advancing movement of the pattern sheet A so that the latter will be stationary while prism 69 moves transversely across it.

Suitable means for controlling operation of the rollers 78 and 79 and timing of the prism traverse comprise a circuit including a manually operated switch 101 and in which one terminal of each of the coils 81 and 82 is periodically connected electrically to a distributor bar 91, Figure 5, through a switch 99 actuated by a cam 100 mounted on shaft 43 and, during other portions of the operation, through a relay actuated switch S.

The other terminal of coil 81 is connected to a distributor bar 93 and the other terminal of coil 82 to distributor bar 92. A contact carrier 94 secured to and movable to and fro with the shutter strip 67 is provided with interconnected brushes in the form of spring contacts or arms 95, 96 and 97. The bars 91, 92 and 93 are conveniently mounted in a panel board 98 and so positioned that when carrier 94 is in its extreme left hand position, as shown in Figure 5, bars 91 and 93 are connected electrically through arms 95 and 97. When the carrier is in the opposite or extreme right hand position, bars 91 and 92 are electrically connected through arms 95 and 96.

A relay coil 83 of switch S is in circuit with the bars 92 and 93 and when energized actuates the moving member 84 of said switch S, said moving member being preferably pivoted at one end and having its free end positioned to move to and from a fixed terminal 85. A spring 87 holds the member 84 normally out of engagement with terminal 85 when coil 83 is deenergized.

In operation, assuming the parts to be at rest in the relative positions indicated in Figure 5, the cam actuated switch 99 closes, thus closing the circuit through coil 81 and deflecting roller 78 so that carrier 94 moves toward the right. As soon as carrier 94 moves far enough to bring arm 96 into engagement with bar 92, the circuit of magnet coil 82 is closed but this does not affect the position of armature 80 which remains in engagement with the core of coil 81. Relay 83 is energized simultaneously with magnet coil 82 and closes switch S after which the cam operated switch 99 is opened and remains open during the remaining traverse of carrier 94 toward the right. As carrier 94 approaches its right hand position, arm 97 disengages from bar 93 to open the circuit of coil 83, thus opening switch S. With switch 99 still open, the circuit of coil 81 is broken so that armature 80 is free to assume its intermediate position. After an interval sufficient to advance the pattern strip and to complete the laying of at least one filler thread, switch 99 is again closed by cam 100, thus establishing the circuit through bar 92 and coil 82 to reverse the direction of movement of strip 67. The switches 99 and S then operate as before in a cycle which is repeated either at the will of the operator or during continued fabric forming operation of the loom.

During to-and-fro movement of the carrier 94 and operation of devices effective incidental thereto, the prism 69 has a corresponding movement of equal extent and cooperates with the cell 53 and pattern sheet A to produce varying currents in accordance with the varying intensities of light transmitted to said cell through the pattern, as

previously described. As shown in Figures 5 and 8, the coils 50 are in circuit with a plurality of separate contact terminals 103 and the distributor bar 91 with which the arm 95 remains continuously in sliding contact during oscillation of the carrier 94. Another contact arm 104 connected electrically with said arm 95 is mounted on carrier 94 and therefore moves successively in both directions across the contacts 103, so that the current condition existing in the circuit of each of said contacts 103 by reason of the strength or weakness of light intensity through the respective pattern units corresponding to the respective terminals or contacts is transmitted to or becomes effective in a corresponding coil 50. If the unit is dark no heddle movement will take place; if light, the heddle will be deflected in the manner and for the purposes hereinbefore described.

Referring to Figure 8, the shutter strip actuating motor 76 is in a circuit which includes a switch 105. When the latter is open, the selector mechanism hereinabove described will remain inoperative. Similarly, if the switch 106 in the circuit of lamp 62 or the switch 107 in the circuit of cell 53 be opened, the design or pattern selector devices stop effective operation. Any or all of these or other expedients may be employed to interrupt or restrain operation of the selector devices independently of the normal fabric forming mechanisms.

Although the pattern sheet A has been described as comprising light areas and dark areas which define the design, it will be apparent that the filler threads or yarns of the fabric to be formed may be of any variety of color or of tone value. For example, the designs may call for blue and red fillers in which case the filler thread controlling or selecting mechanism will be coordinated to operate in any desired relation to the selecting devices hereinabove described.

I claim as my invention:

1. In pattern control mechanism for looms and the like, the combination of a pattern element presenting a pattern defined by light and light and dark portions, means for intermittently advancing said element, a photo-electric cell, and means movable transversely of the pattern element for effectively transmitting to said cell increments of light which vary in cell affecting value according to the light value affecting characteristics of said light and dark portions of the pattern.

2. In pattern control mechanism for looms and the like, the combination of a pattern sheet presenting a pattern defined by light and dark portions, means for intermittently advancing said sheet, a photo-electric cell, and means operative between increments of advance of said pattern sheet for effectively transmitting to said cell light which varies in cell affecting value according to the light

- value affecting characteristics of said light and dark portions of the pattern, said means including a source of light, a reflector mounted to direct light rays toward said cell, and means for reciprocating said reflector in the path of light rays affected by said light and dark portions of the pattern.
3. In a loom having heddles and means for effecting endwise movement thereof, the combination of a plurality of heddle moving members, means for actuating each of said members including means tending normally to move said member in one direction, an electro-magnet having an armature operatively connected to said member and tending normally to retain said armature and said member retracted in the opposite direction, and means for controllably releasing said armature including a pattern element presenting a pattern defined by portions having characteristics which affect in different degrees the value of light transmitted therethrough, a photo-electric cell means for presenting said cell in operative relation to successively occurring transversely aligned portions of said pattern sheet, and an amplifier having its input connected to said cell, and means for connecting its output to said electro-magnets in succession.
4. In pattern control mechanism for looms, the combination of a pattern sheet having portions of different light obstructing characteristics, a source of light at one side thereof, a photo-electric cell, means at the other side of said pattern sheet for transmitting to said cell light rays passing through said portions of said sheet, a plurality of electro-magnets separately electrically connected with said cell, and means for moving said light ray transmitting means transversely across said sheet and across the path of light rays passing through successively disposed portions thereof.
5. In pattern control mechanism for looms, the combination of a pattern sheet having portions of different light obstructing characteristics, a source of light at one side thereof, a photo-electric cell, means at the other side of said pattern sheet for transmitting to said cell light rays passing through said portions of said sheet, a plurality of electro-magnets separately electrically connected with said cell, said means comprising a reciprocatable strip attached to said light ray transmitting means, driving means therefor, and means for periodically arresting movement of the strip and reversing the direction thereof.
6. In a loom, the combination of a plurality of heddles, a plurality of heddle bars engaging said heddles and movable endwise, a plurality of levers each having its free end engaging a heddle bar, a spring secured to each lever and normally tending to deflect said free end of the lever in one direction, a magnet having an armature connected to said lever and normally tending to retain said armature in retracted position whereby the free end of the lever is held retracted in the opposite direction, a pattern sheet comprising a photographic representation of a design to be reproduced in the fabric, a coil on each magnet adapted when energized to diminish the armature retaining effect thereof, a source of light at one side of said photograph, a photo-electric cell connected separately to each of said coils, a reflector positioned at the other side of said photograph and in operative relation to said cell, and means for moving said reflector back and forth in the path of light rays passed through the photograph.
7. A loom having warp raising and lowering instrumentalities and means for moving a portion thereof laterally, including means normally tending to deflect said portion in one direction, a magnet having an armature operatively connected to said deflecting means and tending normally to retain said armature and said deflecting means retracted in the opposite direction, and means for selectively varying the effective fields of said magnets in succession to release their respective armatures whereby the latter are permitted to be moved away from said magnets with said deflecting means.
8. In pattern control mechanism for apparatus having fabric forming instrumentalities and means for separately actuating each of the same, the combination of means for operatively positioning portions of said actuating means, means tending normally to move said positioning means in one direction, a magnet for each separate instrumentality actuating means and having an armature operatively connected to said positioning means and tending to retain said armature and said positioning means retracted in the opposite direction, and means for selectively varying the effective fields of said magnets to release their respective armatures successively from said retracted position.
9. In pattern control mechanism for apparatus having fabric forming instrumentalities and means for separately actuating each of the same, the combination of means for operatively positioning portions of said actuating means, means tending normally to move said positioning means in one direction, a magnet for each separate instrumentality actuating means and having an armature operatively connected to said positioning means and tending to retain said armature and said positioning means retracted in the opposite direction, a pattern element presenting a pattern defined by portions having characteristics which affect in different degrees the value of light transmitted therethrough, and light sensitive means cooperating with said pattern element and successively with said magnets to separately selectively vary the effective fields thereof in re-

sponse to differences in characteristics of transversely aligned pattern defining portions of said pattern element in respect to the value of light transmitted therethrough.

5 10. In pattern control mechanism for looms, the combination of a pattern sheet having portions of different light obstructing characteristics, a source of light at one side thereof, a photo-electric cell, means at
10 the other side of said pattern sheet for transmitting to said cell light rays passing through said portions of said sheet, a plurality of electro-magnets separately electrically connected with said cell, said means
15 comprising a reciprocable strip attached to said light ray transmitting means, and driving means therefor.

11. In a loom having heddles and means for effecting endwise movement thereof, the
20 combination of a heddle moving member, means for actuating said member including means tending normally to move said member in one direction, an electromagnet having
25 an armature operatively connected to said member and tending normally to retain said armature and said member retracted in the opposite direction, and means for controllably releasing said armature including a pattern element presenting a pattern defined by
30 portions having characteristics which affect in different degrees the value of light reflected therefrom, a photo-electric cell, means for presenting said cell in operative relation to successively occurring transversely aligned
35 portions of said pattern sheet, and an amplifier having its input connected to said cell, and means for connecting its output to said electromagnets in succession.

12. In pattern control mechanism for apparatus having fabric forming instrumentalities and means for separately actuating each of the same, the combination of means for operatively positioning portions of said
40 actuating means, means tending normally to move said positioning means in one direction, a magnet for each separate instrumentality actuating means and having an armature operatively connected to said positioning
45 means and tending to retain said armature and said positioning means retracted in the opposite direction, a pattern element presenting a pattern defined by portions having characteristics which affect in different
50 degrees the value of light reflected therefrom, and light sensitive means cooperating with said pattern element and successively with said magnets to selectively and separately vary the effective fields thereof in response
55 to differences in characteristics of transversely aligned pattern defining portions of said pattern element in respect to the value of light reflected therefrom.

13. A loom having warp raising and lowering instrumentalities and means for moving
60 a portion of each thereof laterally, in-

cluding means normally tending to deflect said portion in one direction, a magnet having an armature operatively connected to said
70 deflecting means and tending normally to retain said armature and said deflecting means retracted in the opposite direction, and means for selectively diminishing the effective fields of said magnets in succession to release their
75 respective armatures whereby the latter are permitted to be moved away from said magnets with said deflecting means.

14. In pattern control mechanism for apparatus having fabric forming instrumentalities and means for separately actuating each of the same, the combination of means
80 for operatively positioning portions of said actuating means, means tending normally to move said positioning means in one direction, a magnet for each separate instrumentality actuating means and having an armature
85 operatively connected to said positioning means and tending to retain said armature and said positioning means retracted in the opposite direction, and means for selectively diminishing the effective fields of said magnets to release their respective armatures
90 from said retracted position.

15. In pattern control mechanism for looms and the like, the combination of a pattern sheet presenting a pattern defined by
95 light and dark portions, means for intermittently advancing said sheet, a photo-electric cell, and means for effectively transmitting to said cell light which varies in cell affecting value according to the light value affecting
100 characteristics of said light and dark portions of the pattern, said means including a source of light, a reflector mounted to direct light rays toward said cell, and means for reciprocating said reflector in the path of light rays
105 affected by said light and dark portions of the pattern.

16. In selective control apparatus, the combination of an electromagnet having a core and coils wound in opposite directions thereon, an armature, means tending normally to
110 move said armature away from said core, means for periodically moving the armature into contact with the core, means for energizing the coils, and means for periodically deenergizing one of said coils while the armature engages said core.
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17. In selective control apparatus, the combination of a magnet, an armature, means tending normally to move said armature away
120 from said magnet, means for periodically moving the armature into contact with the magnet, and means for periodically diminishing the field strength of said magnet to release the armature from engagement there-
125 with.

18. In pattern control mechanism for looms and the like, the combination of a pattern sheet presenting a pattern defined by
130 light and dark portions, means for intermit-

tently advancing said sheet, a photo-electric cell, and means for successively transmitting to said cell increments of light which vary in cell affecting value according to the light value affecting characteristics of transversely aligned light and dark portions of said pattern, said means including a source of light, a reflector mounted to direct light rays toward said cell, and means for reciprocating said reflector in the path of light rays affected by transversely aligned light and dark portions of the pattern.

19. A loom having warp raising and lowering instrumentalities, including means for moving a portion of each thereof laterally comprising a spring, a magnet having an armature operatively connected with said spring and normally tending to hold said armature retracted in a direction opposed to the spring, means for selectively varying the effective field of one after another of said magnets to progressively release their respective armatures, and means for moving said armatures toward said magnets against tension of their respective springs.

20. In pattern control mechanism for looms, the combination of a pattern sheet having portions of different light obstructing characteristics, a source of light at one side thereof, a photo-electric cell, means at the other side of said pattern sheet for transmitting to said cell light rays passing through said portions of said sheet, a plurality of electromagnets, means for separately electrically connecting said electromagnets with said cell, said means comprising a reciprocable strip attached to said light ray transmitting means, and driving means therefor.

21. In pattern control mechanism for looms and the like, the combination of a pattern element presenting a pattern defined by light and dark areas, a photo-electric cell, and means reciprocable transversely of the pattern element to transmit in succession to said cell light rays which vary in cell output affecting value according to variation in the light value affecting property of transversely aligned areas of said pattern.

In testimony whereof, I have signed my name to this specification this 21st day of March, 1929.

GARDINER C. MEANS.

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CERTIFICATE OF CORRECTION.

Patent No. 1,904,006.

April 18, 1933.

GARDINER C. MEANS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, line 114, claim 1, strike out the words "and light"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of May, A. D. 1933.

(Seal)

M. J. Moore.
Acting Commissioner of Patents.